HEATING ELEMENT ACCESSORY HAVING WARNING DEVICE

Priority Information

This patent application is a continuation-in-part patent application of United States Patent application no. 10/429,111 entitled Heat Warning Devices Directly Applicable to Hot Surfaces filed May 2, 2003 by William S. Lerner, incorporated herein by reference, of United States Patent application no. 09/788,594 previously filed by Applicant and Inventor William S. Lerner on February 21, 2001 and which is incorporated herein by reference in its entirety and of United States patent application no. 10/238,348 previously filed by Applicant and inventor William S. Lerner on September 10, 2002 and which is incorporated herein by reference.

Field of the Invention

The present invention relates to safety devices used in cooking or other activities involving hot surfaces, and in particular it relates to safety devices applied directly to the hot surfaces and which alert someone that the surface of a stove or other appliance or device is too hot to touch.

Background of the Invention

Applicant's previous applications referred to above and Applicant's U.S. patent no. 6,104,007 to Lerner, incorporated herein by reference, have explained in detail the need for a heat warning safety device to notify users that a particular surface remains hot. As explained, a prime purpose is to warn children in a household setting of the need not to touch particular surfaces. Another prime purpose is to warn adults of the same thing.

Over two million people in the United States suffer burns due to thermal injuries each year. All you need is one second of contact at a temperature of 167 degrees Fahrenheit for an adult (160 degrees Fahrenheit for a child or the lederly) to cause a burn.

As previously explained, versatility is an important aspect of the heat warning safety devices in that they should be applicable to any surface that can be hot or remain hot. Accordingly, previous applications by Applicant disclose detachable heat alert safety devices. However, such devices are subject to the risk of being tampered with and removed by children. On the other hand, heat warning safety devices that are built in to the appliance are not versatile. They cannot easily be applied to any appropriate surface. Any device by its nature also uses up physical space since the thermochromic composition has a container and the container has to be attached to the surface of the appliance by either a magnet, an adhesive layer or some other attachment element. Consequently, the heat warning safety device typically juts out of the surface. That may make the surface bulkier.

Furthermore, the heat warning safety device that appears on the surface of an appliance necessarily uses up a certain amount of visual space. In other words, the surface of an appliance has a logo on it and possible other information such as instructions. It is important for appliance manufacturers to allow their logo to stand out. It is well established principle of writing advertising copy that having too busy a visual environment makes it difficult to catch the attention of the viewer to the desired message; whereas empty visual space near the message draws the viewer's eye to the message. It is therefore desirable for any heat warning device to minimize the amount of visual space it uses on the surface of the appliance.

In general, moreover, consumers do not want the top surface of their stoves to be marred by bulky contraptions, even for safety.

In addition, while minimizing the visual space used by a heat warning safety device may be desirable on the hot surface of an appliance, the countervailing consideration is that children

cannot be expected to know where to look for heat warning without a conspicuous symbol conveying the heat warning. On the other hand, since adults could reasonably be expected to be taught to look at a surface to see whether a heat warning appears on the surface with a minimized visual prompt, and since children may not be similarly trainable, there is also a need for a heat warning safety device that is custom tailored for both children and adults.

Furthermore, while known heat warning safety devices can be made to fit a curved or a straight surface, one of such devices would not be expected to physically fit against both a curved and a straight surface.

There is also a need for a heat warning safety device that can communicate different degrees to which the surface of the appliance or other object is dangerously hot, i.e., hot versus very hot.

One important example of a surface that often gets hot and stays hot after the source of the heat has been removed and hence requires a heat warning is the surface of the metal grates that cover the burners of a gas stove. As noted, the present inventor has filed other patents on the general subject matter of this patent application. U.S. Patent No. 6,104,007 to Lerner discloses with respect to a gas stove a central metal element having a disk thereon with a thermochromic composition embedded on the disk as a heat warning device on the gas stove. At the time of the '007 patent it was thought that the ideal position for the heat warning device was on such a disk. It was conventional wisdom at that time that the metal grate itself gets too hot to place a heat warning symbol made of a thermochromic composition thereon. Thermochromic compositions that reliably cycle above the maximum temperature that the metal grates of a gas stove could reach (possibly at least four hundred degrees Fahrenheit) may not have been easily available at

that time. Since the grate itself can even glow red hot with intense heat it was thought to be inadvisable to place the heat warning symbol containing a thermochromic composition on the grate where the warning symbol could be damaged, could fall off or could cease to cycle reliably above and below the specified temperature.

Furthermore, it was thought that placing a heat warning device on the metal grate itself could interfere with the heating process by getting in the way of the placement of utensils on the grate. This would especially be true if the heat warning device had significant bulk.

Notwithstanding the conventional wisdom, the '007 patent's placement of the heat warning symbol carries certain drawbacks in relation to the ideal. First, pots and pans that are centered on the heating element of the gas stove will obstruct the view of the heat warning symbol. It is commonplace for small pots and pans to be left on a gas burner after the heat is turned off but where the metal grates are still dangerously hot. If the cooking utensil is small relative to the size of the grates, the metal grate will still be exposed and dangerous to touch.

A second drawback is that whenever a container is used to enclose the thermochromic composition the container is made of a material having a different thermal conductivity than the composition itself. There is a different thermal coefficient of expansion between the two materials. Therefore, a space has to be left between the thermochromic composition and the container. Even though a covering appears on top of the composition, there is always the possibility that food or dirt from the stove could enter the recess between the thermochromic composition. Furthermore, there is a tiny space between the disk and the central metal element that the disk sits on. Tiny crevices between the disk and the central metal element can be receptacles for dirt and food that accumulates from use of the stove. Thus having the heat

warning device directly in the location of pots and pans dripping with overflow of food renders the heat warning device susceptible to the accumulation of food and dirt. This is especially significant today since stoves are being manufactured smooth and smoother on their tops nowadays precisely to avoid the accumulation of dirt and grime on the top surface and make it easier to clean.

A third drawback is that the heat warning symbol is not directly on the metal grate, the item that individuals are being warned against for heat but rather is located on the disk, which is separate from the metal grates. This is not ideal because the discrepancy in location means that the temperature of the disk does not equal the temperature of the metal grates. Hence, the threshold temperature that triggers the change in color of the thermochromic composition has to take this into account. In order to take the difference in temperature into account correctly, the heat warning symbol has to be in fixed relation to the target surface and the intervening materials have to be of known heat conductivity. Furthermore, the discrepancy cannot be too large since to warn individuals that their cooking surface is too hot to touch, i.e. 115 degrees Fahrenheit, you do not want a heat warning symbol that will be triggered at a much lower temperature since the ambient temperature in the room might reach 80 degrees or more. Although these drawback can be managed, everything else being equal it is still preferable to have the heat warning device on the same portion of the equipment that is dangerously hot since the heat dissipation is not perfectly uniform and predictable and since it is simpler and more reliable for a thermochromic composition not to have to calibrate the triggering temperature to take into account the heat dissipation.

There is thus a need for a heat warning safety device that addresses the above concerns

and does not require a container to house it and which can be applied directly to a surface in a simple manner. Furthermore, there is a need for such a device that minimizes the amount of visual space that it uses on the surface.

In addition, certain appliances, for example a toaster, may have multiple surfaces that are not all the same degree of dangerously hot and which would ideally require separate heat warning devices on each surface. Given that and the fact that as previously mentioned each such device uses up physical and visual bulk, it is all the more necessary to have devices or an assembly of devices that do not use up so much physical and visual space.

There is a need for an assembly of heat warning devices that can be placed on multiple surfaces of an appliance or object having hot surfaces. There is also a need for such an assembly each of whose devices has the mentioned advantages of the individual devices.

There is also a need for a heat warning safety device that maximizes the visual impact of the warning it communicates. In other words, there is a need to maximize the visual disparity between the appearance of the device when the surface is not dangerously hot and the appearance of the device when the surface is dangerously hot and a warning is being communicated.

In light of the above discussion there is a need for a device and an assembly of such devices that achieves all of the above objectives and which is also suitable for temperatures of target surfaces at least up to a high temperature of a gas oven (500° F) since many appliances get that hot and of target surfaces significantly higher than 500 degrees for such surfaces as the surfaces of grills and griddles. There is also a need for heat warning devices in which the thermochromic composition can itself be directly exposed to and can withstand temperatures of at least 250 to 300 or more degrees Fahrenheit. There is also a need for a device and an assembly of

such devices that is suitable for temperatures at least 250 to 300 degrees Fahrenheit since thermochromic compositions that are commonly available are reliably stable at cycling back and forth at that temperature and certain surfaces that require a warning device will not get hotter than that temperature.

It is believed that no heretofore known product simultaneously meets these requirements. The present invention does.

Summary of the Invention

The present invention is a heating element accessory such as a drip pan bowl or a metal ring surround a heating element of a cooking appliance and contain a heat warning symbol from thermochromic ink or epoxy sprayed or otherwise applied directly to the hot surfaces thereof. It applies most readily to cooking appliances such as electric and gas stoves, griddles, grills or their accessories. Generally, the heat warning symbol is distanced from the heating element or its hottest portions so that the composition can withstand the high temperature on the surface. In a preferred embodiment the device is invisible when below the triggering temperature and visible thereafter. Besides improved cooking appliances, persons can in certain embodiments update their existing appliances by installing accessories with the heat warning symbol and avoid replacing entire heating elements.

Specific embodiments of the present invention include an improved metal grate for a gas stove, an improved griddle and an accessory for the electric coil of an electric stove all having thereon a heat warning symbol comprising thermochromic ink or epoxy material that is directly applied to a hot surface such as by being sprayed, stamped, stenciled, silk screened, embossed to the hot surface of the appliance.

The most common example of the heat warning symbol is the letters "HOT". In an alternative embodiment of the appearance of the heat warning symbol composed of lettering, when cold (dangerously hot) only the outline of the heat warning symbol is seen and when hot the full symbol is seen. Generally, the thermochromic material is shaped in a predetermined symbol or shape, such as the English letters "HOT" or such letters in another language, or in the background of such a symbol, communicating to a viewer that a surface is dangerously hot. Preferably, although not necessarily, the symbol or its background should lie in the color range red-orange-yellow, commonly recognized colors of both high temperature objects and of required caution. Alternatively an abstract pattern such as alternating wavy lines or a field of exclamation points, normally invisible and becoming red and black at a predetermined temperature, can be continued across a front or back surface of the button, so that portion of the pattern visible to a viewer on the front side of the button will suffice to convey the warning.

In certain instances, a plurality of these symbols may be used on a single surface to maximize the effectiveness of the warning system and to tailor the heat alert warning system to both children, who need guidance as to where to look for said warning symbols, and to adults, as to whom the impact is greatest when the warning symbol appears after being invisible.

The thermochromic composition and device is entirely constructed out of material able to withstand repeated cycling to a temperature of a high temperature, in some case approximately 300 degrees Fahrenheit or more, which makes it effective for target surfaces of 500 degrees Fahrenheit or more, as explained below. The thermochromic composition is durable enough to withstand rough treatment, such as dragging a utensil along the heat warning symbol.

Objects And Advantages

The following important objects and advantages of the present invention are:

(a) to provide a heat warning safety device that is versatile enough to be applied to any surface;

(b) to provide such a device that cannot be tampered with by children or even by adults;

(c) to provide such a device that does not use up a significant amount of physical space;

(d) to provide such a device that does not use up a significant amount of visual space;

(e) to provide such a device that can be custom tailored for both children and adults;

(f) to provide such a device wherein the same device can be applied to both a straight surface and a curved surface;

(g) to provide such a device that can communicate differing degrees of dangerously hot, i.e. differing levels of heat;

(h) to provide such a device that is easy to apply and easy to manufacture;

(i) to provide such a device that can withstand high temperatures, i.e. approximately 250 to 300 degrees Fahrenheit or more if necessary;

(j) to provide such a device that can function effectively as heat warning device for target surfaces that experience surface temperatures of approximately 800 to 1200 degrees Fahrenheit;

(k) to provide such a device that can form part of an assembly of such devices covering one or multiple surfaces of a particular appliance or object;

(l) to provide such a device that can maximize the visual impact of the heat warning symbol by maximizing the disparity between the warning symbol when cold and the symbol when dangerously hot;

(m) to provide a device that instantly warns anyone including a child that the surface of an appliance or other hot object is too hot to touch,

(n) to provide a versatile heat warning device that can be applied to and used on the widest possible range of surfaces and materials

(o) to provide a heat warning device that is easy to manufacture for various kinds of stoves or other appliances,

(p) to provide a heat warning device for stoves that can be calibrated to produce a warning symbol only when a certain temperature, such as 115 degrees Fahrenheit, is reached and that can remain in signaling mode as long as such temperature is exceeded by the appliance surface,

(q) to provide a heat warning device as above that makes use of thermochromic compositions that change color when a certain temperature is reached, such as cholesteric or chiral nematic liquid crystals or Lucodyes® designed to change color when a certain temperature is reached, and

(r) to provide a heat warning device that is readable by children,

(s) to provide an improved grate of a gas stove containing at least one heat warning symbol that is readily visible and effective even when a particular cooking utensils, such as a pot or pan, is located on the grate;

(t) to provide an improved metal grate for a gas stove that blends perfectly into the existing equipment

(u) to provide an improved metal grate that does not require the addition of any new parts

(v) to provide an improved metal grate for a gas stove that is no harder to clean that the

existing metal grates

(w) to provide an improved metal grate that does not serve as a repository for dirt and grime,

(x) to provide an accessory for an electric coil for an electric stove that blends perfectly into the existing equipment;

(y) to provide an accessory for an electric coil of an electric stove that is easy to clean;

(z) to provide an improved grill and an improved griddle that contains at least one heat warning symbols without serving as a repository for the collection of food and grime;

(aa) to provide an improved grill that contains at least one heat warning symbol that blends perfectly into the grill and likewise to provide an improved griddle containing at least one heat warning symbol thereon that blends perfectly into the griddle.

(bb) to provide an improved griddle containing at least one heat warning symbol that is readily visible and effective even when a particular cooking utensils, such as a pot or pan, is located on the griddle;

(cc) to provide an improved grill containing at least one heat warning symbol that is readily visible and effective even when a particular cooking utensils, such as a pot or pan, is located on the grill;

(dd) to provide an accessory for the heating element of a gas stove containing at least one heat warning symbol that is readily visible and effective even when a particular cooking utensils, such as a pot or pan, is located on the heating element of the gas stove;

(ee) to provide an accessory for the heating element of an electric stove containing at least one heat warning symbol that is readily visible and effective even when a particular cooking

utensils, such as a pot or pan, is located on the heating element of the electric stove;

Brief Description of The Drawings

FIG. 1 is an isometric view of the assembly of the present invention on an unheated toaster.

FIG. 2 is an isometric view of the assembly of the present invention on a heated toaster.

FIG. 3 is a fragmentary plan view of one of the type one devices of the assembly of the present invention when cold.

FIG. 4 is a fragmentary plan view of one of the type one devices of the assembly of the present invention when hot.

FIG. 5 is a sectional view taken along line 5–5 of FIG. 4.

FIG. 6 is a fragmentary plan view of one of the type two devices of the assembly of the present invention when cold.

FIG. 7 is a fragmentary plan view of one of the type two devices of the assembly of the present invention when hot.

FIG. 8 is a sectional view taken along line 8–8 of FIG. 7.

FIG. 9 is an isometric view of a cup and lid with a segmented warning symbol in accordance with an alternative embodiment of the present invention having thermochromic composition capable of depicting the words "OK", "HOT" and "VERY HOT" and with the segment "HOT" active both on the lid and on the cup.

FIG. 10 is an isometric view of a lid with an alternative embodiment of a segmented warning symbol in accordance with the present invention having thermochromic composition capable of depicting the words "OK" and "HOT" and with the segment "OK" active.

FIG. 11A is tri-segmented heat warning symbol for any surface in accordance with the present invention, and

FIG. 11B is a bi-segmented heat warning symbol for any surface in accordance with the present invention.

FIG. 12 is a top plan view of a heat warning symbol of the present invention located on the base of a metal grate of a gas stove.

FIG. 13 is a top plan view of the accessory of the present invention surrounding a metal grate of a gas stove.

FIG. 14 is a sectional view of the accessory shown in FIG. 13.

FIG. 15 is a top plan view of an accessory of the present invention surrounding an electric coil heating element with the drip pan containing the heat warning symbol.

FIG. 16 is a sectional view of the accessory shown in FIG. 15

FIG. 17 is a top plan view of an accessory of the present invention surrounding an electric stove with the symbol on the metal ring surrounding the drip pan.

FIG. 18 is a sectional view of the accessory shown FIG. 17.

FIG. 19 is a top plan view of an accessory of the present invention surrounding a grill.

FIG. 20 is a sectional view of the accessory shown in FIG. 19.

FIG. 20a is a sectional view of an improved outdoor grill of the present invention with the symbol on the outer perimeter of the grill.

FIG. 21 is a top plan view of the apparatus of the present invention surrounding a griddle with the symbol on the outer perimeter of the griddle above a buffer layer.

FIG. 22 is a sectional view of the apparatus shown in FIG. 21

FIG. 22a is a sectional view of an alternative embodiment showing the accessory on the metal ring surrounding the drip pan.

FIG. 23 is a top plan view of the accessory of the present invention surrounding a griddle with the symbol on the drip pan.

FIG. 24 is a sectional view of the accessory shown in FIG. 23

Detailed Description of The Drawings

Various embodiments of the invention disclosed in my prior application of which this application forms a continuation-in-part and in my prior below-identified U.S. Patent will first be recited for completeness. Thereafter the specific embodiment which is the material of this patent will be described.

The use of a stippling in the drawing figures is intended to communicate the color red or another conspicuous color different from the background color of the surface.

The term "target surface" as used herein refers to the surface that the individual is being warned may be dangerously hot.

The heat alert device of the present invention when used for the smooth surface of cooktop stoves of either type would comprise thermochromic composition 32 embedded in the top surface of each glass area 30, which is the heating element on the smooth cooktop stove using known methods. For example, the thermochromic composition 32 may be made in the exact shape of the letters "HOT" by spraying the composition of thermochromic material 32 over each glass area 30 after covering the glass area 30 with a cardboard stencil or other cut-out in the outline or shape of the letters "HOT". As before, the liquid crystal or thermochromic composition is designed to turn red and remain red whenever the temperature of the smooth area of glass

exceeds a specified temperature, such as 115 degrees Fahrenheit.

It should be noted in general that the present invention makes use of any thermochromic composition that changes color and remains at that color when a specified temperature is reached or exceeded - it need not necessarily be cholesteric, although it has been found that cholesteric liquid crystal material does this effectively. It is also within the scope of the present invention to make use of a thermochromic composition that changed color when it reached a specified temperature or temperature range but changed to a third color at a higher threshold temperature, so long as the third color is significantly different from the first color - although this would certainly not be the ideal kind of thermochromic composition.

The ideal heat warning symbol is a color known to represent warning, such red or orange, although as indicated any color is contemplated by the present invention.

It should be understood clearly that the thermochromic composition of the present invention reveals a predetermined symbol whenever and so long as the temperature of the surface that the composition is on exceeds a predetermined temperature. This can be arranged in more than one way. For example, this can happen as a result of the thermochromic composition turning color and being shaped in the shape of the heat warning symbol (or the background of such symbol). It can also happen as a result of the thermochromic composition covering the heat warning symbol and then becoming invisible at the triggering temperature.

In either case, the thermochromic composition, when the triggering temperature is reached, simply turns into a color that makes the symbol readily visible. For example, the thermochromic composition can turn red at the triggering temperature and be shaped in the form of the symbol or shaped in the background of the symbol. The second way is that the

thermochromic composition, until the triggering temperature occurs, blocks the visibility of a red heat warning symbol underneath it. When the triggering temperature arrives, the thermochromic composition becomes invisible and reveals the underlying red symbol.

In either case, it is preferable that the entire heat warning symbol and the thermochromic composition be substantially invisible against a background color of the surface prior to the triggering temperature being exceeded. This is so that the presence of the heat warning device be unknown prior to the triggering temperature being exceeded. This has two advantages: (i) the warning is more dramatic when it arrives and (ii) the presence of the warning does not clutter or mar the appearance of the surface of the stove or other appliance

In the case where the thermochromic composition covers a previously written or formed heat warning symbol, preferably, the heat warning symbol was formed or written underneath the thermochromic composition by whatever well known processes employ the least expensive means, such as printing, writing, stamping, scratching, etc.

With use of the present invention, when an individual enters a kitchen that incorporates either a stove or other appliance having a hot surface, he or she can instantly recognize if any of the heating elements of the stove or any surfaces of the appliance are too hot. This is in contrast to the prior art for which the person would have to first figure out which heating element corresponds to which light indicator.

It is to be understood that a heat symbol can take multiple forms and is not limited to the letters "HOT". The present invention contemplates that other letters and other letter shapes besides that of "HOT" could be used as a warning symbol although it is believed that the simple arrangement of the letters "HOT" in a bold simple typeset provide the best warning symbol. The

symbol may also take the form of a exclamation point, an international "no" symbol superimposed a stick diagram of a figure touching a surface, a stylized human face showing shock or pain, a representation of flames, or any other recognizable warning symbol. Furthermore, the present invention also contemplates that the thermochromic composition in the outline of the letters "HOT" can be embedded in a surface of a stove, toaster oven or other appliance where the surface is vertical and perpendicular to the floor, not only horizontal. In addition, while the drawings depict the thermochromic composition embedded on the surface of the stove in a particular configuration and depth, it is contemplated by the present invention that the depth and configuration of the thermochromic composition can vary and still be within the scope of this invention.

As noted, it is also contemplated by the present invention that in addition to the thermochromic composition being in an outline of the heat warning symbol in certain embodiments, such as in the shape of the letters "HOT", the thermochromic composition could instead be in the background of such an outline. By this is meant that the thermochromic composition would form the entire area except an outline of the letters "HOT".

The point of one feature of the present invention is to use the thermochromic composition to create a color contrast between a color such as red or some other color in order to depict the letters "HOT" in red or that color whether by virtue of the thermochromic composition itself being the letters "HOT" or whether the thermochromic composition surrounds the letters and in effect constitutes everything else except the letters "HOT" or whether the thermochromic composition covers a previously inscribed symbol and becomes invisible to reveal such symbol at the triggering temperature.

Furthermore, it should be noted that in this patent application, the term "red" refers to all possible variations and shades of the color red as well as to all possible variations of the colors orange and yellow. Red and orange and yellow are the colors associated with heat. Furthermore, if the hot surface (as opposed to the area of the thermochromic composition) itself is or becomes red when hot, then the thermochromic composition would have to be orange and vice versa.

The term "appliance" is a broad term that encompasses any appliance and any object that has a hot surface. Many appliances have curved surfaces and the present invention can be applied directly to such surfaces, which further maximizes the viewing angle of the warning. The hot surfaces are typically metal or glass but can be of other suitable materials such as philonic.

With respect to thermochromic compositions referred to herein for the claimed embodiments, it is believed that the desired thickness of the ink or epoxy composition is approximately 2 mils. So for example, if the application process used in order to directly apply the ink or epoxy thermochromic composition to the surface is the silkscreening process, it is believed that employing a single pass or multiple passes using a 70 to 80 course screen would result in 2 mils of thickness of ink or epoxy.

The present invention is described in various embodiments in which a heat warning symbol is applied on a particular surface. It is of course possible and indeed necessary that more than one such heat warning symbol be applied to certain surfaces. That can occur for several reasons. The surface may be approached from several directions or there needs to be multiple symbols to increase the strength of the warning since the symbol needs to be small given the thinness of the surface the symbol is applied to. Accordingly, For example, where an improved grate, grill, griddle or an accessory for an electric stove is described in this patent application as having a heat

warning symbol positioned on its surface, it should be understood that several such heat warning symbols can and in some cases should be placed on such surface in accordance with the present invention.

Two or more sides or walls of an appliance can sometimes get hot and the one side might not be suitable to have a heat alert safety device attached to it even though the same heat alert safety device of the present invention is made specifically for the other side of the same appliance. This application is especially useful for kitchen workers surrounded by multiple ovens and/or hot counters - they can place the device on each such hot surface. Other surfaces that get hot and to which device can be usefully applied besides food related appliances include radiator caps located under the hood of a car or other vehicle, piping through which hot steam flows, the surface of a curling iron, surfaces of a steam press and many others listed herein in the Objects and Advantages.

The apparatus of the present invention will now be illustrated by reference to the accompanying drawings. A single heat warning safety device in accordance with the present invention has been assigned reference numeral 10. An assembly of such devices has been assigned reference numeral 100. Other elements have been assigned the reference numerals referred to below.

The present invention is designed to provide an overall system for heat warning safety devices that maximizes the effectiveness of the warnings. Although FIGS. 1 through 8 depict the assembly of heat warning devices applied to an ordinary toaster, it will be appreciated that the assembly and individual devices of the present invention are equally suitable for application to any surface that can become hot

As seen from FIGS. 1-8, heat warning safety device 10 is attachable to a surface of a toaster to warning individuals that the surfaces of the toaster is or are hot. Device 10 comprises thermochromic composition 20 shaped in a predetermined symbol or in the background of such symbol which communicates that the surface is dangerously hot, the symbol substantially invisible against a background color of surface 30 and designed to undergo and maintain a readily perceptible color change so that the symbol 20 is readily visible against said background color 30 whenever and so long as the temperature of the surface 30 exceeds a predetermined temperature.

Thermochromic composition 20 does not require a container to house it and does not require an overcoat of another substance to cover it or contain it. It is applied directly to the surface and allowed to dry and remain on the surface without the need for a covering or cured with a UV dryer.

FIG. 1 is intended to show the placement of the heat warning safety devices on an appliance such as a toaster. FIG. 1 shows the device 10 on a front f or a first surface 30A, a top t or second surface 30B and a side s or additional surface 30C of toaster 40. These can also be called a first surface, a second surface and a third surface. Alternatively, FIG. 1 could been example of a toaster having three type one 10A devices 10 when cold, as explained below.

As seen in FIG. 2, there are two versions of the device 10, which can be referred to as a first type 10A and a second type 10B. As seen in FIG. 3, which appears blank, (and in the leftmost surface of FIG. 2) the first type 10A of device 10 is basically invisible or faintly visible when the device 10 is "off", i.e. when the surface to which it is attached is cold. The term "cold" here simply means not dangerously hot as that term is defined. Dangerously hot typically although not necessarily may be 115 degrees Fahrenheit. The reason first type 10A is invisible is

simply that the color of the thermochromic composition 20 is designed to be the same as the background color on the first surface 30A of the toaster 40 whenever the surface temperature does not exceed the specified temperature that would trigger the heat warning symbol to be activated.. As seen in FIG. 4 and the front surface of FIG. 2, when the first surface 30A of the toaster 40 reaches the specified temperature, which may be 115 degrees Fahrenheit, first type 10A of device is activated so that the heat warning symbol, which in FIGS. 1-8 happens to be the letters "HOT", turns red or some other noticeable color.

The first type 10A of device 10 is thus most suited for warning adults. A child cannot be expected to know where to look for a warning device. An adult, in contrast, can be taught to get used to the idea that a particular area of a surface is capable of changing color to communicate a warning and therefore one needs to look there to see if it is hot. The advantage of first type 10A of device 10 is that the visual change from invisible to conspicuous has a greater impact than a change from one color to a different color. Furthermore, by being invisible except when first surface 30A is dangerously hot, the logo of the manufacturer is not visually obstructed by additional information (i.e. the warning symbol) in a tight space that can only hold just so much visual information. This feature appeals to the manufacturer of the appliance.

The second type 10B of device 10 is illustrated in FIGS. 6 and 7 as well as the top or second surface 30B of FIG. 2. As seen in FIG. 6 and the second surface 30B of the toaster 40 in FIG. 2, when cold (not dangerously hot), the second type 10B of device 10 is invisible or faintly visible except for the outline of the heat warning symbol, which in this case is the letters "HOT". In other words, a remainder of the heat warning symbol of the second type 10B of device 10 is invisible or faintly visible and only the outline of the symbol is clearly visible. This is

accomplished by having the outline 20A of the symbol being a permanent marking of a color different than the background color of the surface of the appliance whereas the remainder 20B of the symbol is a thermochromic composition 20B that is identical to the background color of the surface of the appliance (and which becomes red or another color different from the background color upon reaching a specified temperature).

This second type 10B of device 10 is most suited for warning children as to whom an invisible symbol when cold would not prompt or teach the child where to look for a warning. On the other hand, by limiting the visual portion to the outline, the visual space used by type two 10B of device 10 is minimized. By having both types of the device 10, an assembly 100 is custom tailored to all ages of individuals. As seen in FIG. 7, when the second surface 30B of the toaster 40 reaches the specified temperature, which may be 115 degrees Fahrenheit, second type 10B of device 10 is activated so that the heat warning symbol, which in FIGS. 1-8 happens to be the letters "HOT", turns red or some other noticeable color.

It will be understood that the various embodiments and methods of attachment may be combined.

When the thermochromic composition is applied by being sprayed, printed, stenciled, embossed, stamped, silk screened or otherwise applied to the surface 30, the composition 20 is typically applied initially in a liquid or in a malleable solid form. Only then it dries or dries instantly. Accordingly, thermochromic composition 20 is capable of being applied as a liquid directly to the surface 30 in the predetermined shape and it is capable of remaining on surface 30 in its predetermined shape in solid form. It is capable of withstanding temperatures in excess of 300 degrees Fahrenheit.

It should be noted that thermochromic ink and epoxy compositions that withstand temperatures of at least approximately 250 degrees to 300 degrees Fahrenheit are commonly available. Although specialized thermochromic ink and epoxy compositions that withstand higher temperatures, such as 500 degrees Fahrenheit, are also known and available, such specialized thermochromic compositions should only be used if they are necessary. If such specialized compositions are not needed for a particular application, it is preferable to use the more commonly available compositions that only withstand temperatures of up to 300 degrees Fahrenheit. Accordingly, in applying the present invention to various kinds of surfaces, a determination should be made whether the surface is likely to require the more specialized ink and epoxy thermochromic ink and epoxy composition or the more commonly available thermochromic ink and epoxy composition..

Certain surfaces that require a heat warning safety device do not become hotter than 300 degrees Fahrenheit. One reason for this is that it is useful to place the heat warning safety device 10 of the present invention on outer housing surfaces of grills or other appliances in addition to the areas closer to the heating elements. While the heating element itself and the areas immediately proximate to it may well exceed 300 degrees Fahrenheit, the area on the housing of a grill or other appliance is not likely to exceed a temperature of 300 degrees Fahrenheit under normal use. Accordingly, for these application the device 10 of the present invention employs a thermochromic ink or epoxy composition suitable for surfaces that are not likely to exceed a temperature of 300 degrees Fahrenheit.

As best seen in FIG. 5 and FIG. 8, thermochromic composition 20 is very thin. It has the thickness of written ink printed, embossed, sprayed or otherwise applied to a smooth surface.

For example, a smooth surface of an appliance may have embossed thereon a particular logo or product name. If an individual were to close his eyes and feel that surface they would be able to feel the raised ink but only barely. Accordingly, the thickness in solid form of thermochromic composition 20 is such that the thermochromic composition is either faintly visible or invisible when viewed from a line of light tangent to the surface 30 by someone whose attention is not specifically directed to said thermochromic composition. Although FIGS. 5 and 8 do show a visible surface, that is simply to illustrate the fact that there is at least some thickness and is not intended to be to scale.

As noted, typically, composition 20 is applied as a liquid directly to the surface by being printed, sprayed, stamped, stenciled, embossed or silk screened onto said surface. Thermochromic compositions that are suitable are well known and include inks and epoxy resins. For example, the following are examples of thermochromic compositions made by various companies that are applicable to the present invention. Hallcrest, Inc.makes color change products that are temperature sensitive. For example, Hallcrest, Inc. manufactures microencapsulated thermochromic liquid crystal slurries and sprayable microencapsulated thermochromic liquid crystal coatings and Lucodyes®. Chromatic Technologies, Inc. manufacturers Dynacolor® Resin for epoxy screen ink. Matsui International Company, Inc. manufacturers a product called Chromicolor® which is an epoxy resin.

The present invention in the patent application is specifically geared to accessories 100 surrounding hot cooking surfaces containing heat warning symbols 21 and to improved cooking devices containing such heat warning symbols. In both cases, these are surfaces that would benefit from a heat warning accessory or device that does not constitute a bulky intrusion since

Heating Element Accessory Heavy Warning Device

such an intrusion would interfere with the proper functioning of the device having the surface or would disturb the functioning of a device near said surface. Furthermore, the following discussion, which discusses various accessories for cooking appliances and various improved cooking devices, focuses specifically on such accessories and devices that have surfaces that often get hot and remain hot after the heat source is removed and which do not permit the application of a heat warning device that carries a significant amount of bulk. In accordance with the concepts of the present invention, the heat warning symbol 21 has been applied directly to the relevant surface in a preferred embodiment without a covering or container and such direct application has occurred using any of various well-known means described herein, e.g. spraying, printing, embossing, stamping, silkscreening, etc. However, as seen in FIG. 14a, it is also contemplated that by the present invention that in some case a see-through covering 199 or glazed on surface may be added over the thermochromic composition provided that the total thickness of the heat warning symbol plus the covering does not render it too bulky. In a preferred embodiment, the entire symbol and any covering would be approximately one sixteenth of an inch or less. Alternatively, the heat warning symbol could be embedded in the surface so that the top of any covering over the heat warning symbol is smooth with the nearby surface. In any case, the heat warning symbol together with any covering would not protrude out of a surface so much that it would appear to be a bulky intrusion on the surface.

The thickness of the thermochromic composition 20 is less than approximately one sixteenth of an inch in order to minimize the interference with the proper functioning of the accessory that they are on and with the proper functioning of the nearby heating elements of the stove. In a preferred embodiment, the thickness is so small that it is invisible or only faintly visible

when looked at from the side of the surface parallel to the surface. For example, the thickness may be less than approximately one sixty fourths of an inch, certainly less than one sixteenth of an inch. Preferably, the thermochromic composition 20 is either faintly visible or invisible when viewed from a line of sight tangent to the first surface by someone whose attention is not specifically directed to the thermochromic composition. It is believed that the desired thickness of the ink or epoxy thermochromic composition for effectively making use of the heat warning symbol of the present invention is approximately 2 mils, which is understood to be 2/1000 of an inch.

One important example of a surface that often gets hot and stays hot after the source of the heat has been removed and hence requires a heat warning is the surface of the metal grates that cover the burners of a gas stove.

As previously noted, it is counter-intuitive to place the heat warning symbol directly on the metal grates. Nonetheless, in one preferred embodiment, the present invention does place the heat warning symbol at a certain part of these grates in part to have the have the heat warning device on the same item as the item being warned could be dangerously hot. This assures receiving the best reading of the temperature of the grate in the simplest way. Further, the symbol is so thin it does not mar the appearance of the stove's burner. The symbol (when color-activated by the threshold temperature) will be visible in the preferred embodiment even when pots and pans remain on the burner of the gas stove. The symbol is applied directly to the surface so it does not require that there be an additional piece of equipment that attaches to the thermochromic composition or to the surface of the grate. This avoids having crevices that could catch dirt or food are avoided. The heat warning symbol simply blends beautifully into the existing metal

grates of the gas stove. .

In particular, the top visible surfaces of the base or perimeter of the metal grates are a favorable location to warn individuals that the metal grates of the gas stove are dangerously hot. In one preferred embodiment, the visible top surfaces of the base of the metal grates is used to position a heat warning symbol in accordance with the present invention. The prongs of the metal grate themselves support the pots and pans resting on the grate. So the present invention avoids positioning the heat warning symbol on the top surfaces of the prongs themselves - these surfaces endure significant rubbing action from the placement, shifting and removal of cooking appliances thereon. The present invention thus maintains the durability of the heat warning symbol and avoids allowing its effectiveness to be impaired or destroyed. The heat warning symbol is positioned on the visible surfaces of the base of the grates since the base is configured to be lower in height than the prong's top surface on which the pots and pans rest. The base of the grates form the perimeter of the grates. Accordingly, the base of the grates is an excellent place to position a heat warning symbol. It is visible to the user of the stove. It is located at the edge of the potentially hot surface so the user's hand would typically cross the perimeter before putting the hand on the grates and the user would see the heat warning symbol before touching the hot metal grate. Also, a warning symbol on the base would not be affected by moving and removing pots and pans on the grates.

Furthermore, since the base of the grate is lower than the far ends of the prongs which glow red hot at times, the base is cooler than the hottest portion of the grate. This distance in space and the resulting temperature differential permits a thermochromic composition to be durable and effective on the base. Yet since the thermochromic composition would still be

separated from the hottest portions of the prongs of the grate only by intervening metal of the same grate, the triggering temperature of the thermochromic composition on the base can still effectively be calibrated to take into consideration the temperature on the remaining surface of the grate.

As seen in FIG. 12, the heat warning symbol made of thermochromic composition 20 is located on a surface of base 96 which is at the outer perimeter of a metal grate 99 which is the heating element of a gas stove. Base 96 often has a flat upper surface that is approximately one half inch to three quarters of an inch wide and that accommodate the heat warning symbol 21.

Accordingly, the present invention contemplates an improved metal grate for a gas stove comprising a metal grate 99 having a base 96 that forms a perimeter of the grate 99 and having a plurality of prongs, each prong 97 protruding from the base and rising inwardly toward a central flame area

The improved metal grate also includes a heat warning symbol (or multiple heat warning symbols) on a surface of the base for warning individuals that the grate is hot. The heat warning symbol comprises a thermochromic composition shaped in a predetermined symbol or in the background of said symbol which communicates that the surface is dangerously hot, the symbol designed to undergo and maintain a readily perceptible color change whenever and so long as the temperature of the surface exceeds a predetermined temperature. The thermochromic composition is capable of withstanding high temperatures. In a preferred embodiment, the thermochromic composition is capable of withstanding temperatures in excess of approximately 300 degrees Fahrenheit. The heat warning symbol has a thickness of less than approximately one sixteenth of an inch. preferably, the heat warning symbol lacks any covering or overcoat since it is applied directly to

the surface of the grate by any of the means described in this patent application such as spraying, embossing, stamping, printing, silkscreening, etc. The metal grate supports cooking utensils placed thereon In a preferred embodiment, the thermochromic composition would be substantially invisible against a background color of the surface of the base and would become readily visible against that background color or would reveal a heat symbol that is readily visible against that background color whenever and so long as the specified temperature is reached.

The heat warning symbols could be positioned conspicuously along the perimeter of the grate in a manner readily visible and understandable to a user standing in front of the stove. By "understandable" is meant that is for example the heat warning symbol consists of lettering, at least one instance of the lettering will be facing the viewer standing in front of the stove. If the stove is on an island whereby it can be approached in all four directions, each direction could have a heat warning symbol facing a person approaching the stove in that direction. This best illustrated in FIG. 12.

In this embodiment, and similarly in the other embodiments that follow, the thermochromic composition itself need not withstand one particular level of heat but could be capable of withstanding other levels of heat. Furthermore, the thermochromic composition could be positioned at varying distances from the target surface so as to be useful for warning against heat on target surfaces that experience heat levels from 250 degrees up to approximately 800 to 1200 degrees Fahrenheit, depending on the target surface.

In an alternative preferred embodiment, a ring of metal or other heat conducting material is positioned surrounding each metal grate of the burner of the gas stove. This would allow the heat warning symbol to be positioned on a top visible surface of the metal ring surrounding the

grate rather than on the grate itself. Accordingly, individuals could update their existing gas stove by adding metal rings around the grates where the rings themselves would have heat warning symbols on one of more of their surfaces. These individuals would thus not have to replace their existing metal grates for each burner of the gas stove in order to install warning symbols on the grates for each burner area. Rather they could just purchase the metal rings that contain heat warning symbols. Such rings would be less expensive than the metal grates. Furthermore, the heat warning symbol would not be affected by friction on the metal grates from movement of the pots and pans resting thereon. Although the metal rings would cool off sooner than the metal grates given that they are further from the flame area in the center of the grates, this would be taken into consideration. Accordingly, in a preferred version of this embodiment, the thermochromic composition making up the heat warning symbol on the rings would be calibrated so as to warn of dangerous heat whenever the temperature of the metal grate was too hot.

Another important type of surface that often gets hot and stays hot after the source of the heat has been removed and hence requires a heat warning is the surface of the insulated serpentine electric coil heating element which coil typically sits on a grate on the top surface of the electric stove. Typically these electric coils sit on a drip pan, which is a metal bowl designed to collect food residue that drips under a heating element such as the electric coil. It is believed that this is the case with the electric range made by or for GE®. As best seen in FIGS. 16, 18, 20, and as is often the case, the drip pan is held up by a metal ring that engages the top surface 103 of the stove and prevents the drip pan from falling through the opening in each burner. The metal bowl or drip pan typically has an upper lip. Typically, that upper lip of the drip pan covers most of the

width of the upper surface of the metal ring but some portion remains visible.

Accordingly, individuals could update their existing electric stove by adding metal rings around each electric coil and the rings themselves would have heat warning symbols on the outer portion of the upper surface. Alternatively, they could update their electric stove by replacing the drip pan with a drip pan having the heat warning symbol on its upper lip. In either case, these individuals would thus not have to replace their existing electric coils for each heating element of the electric stove in order to install warning symbols on the stove. For a four heating element electric stove, the cost of four new electric coils could be approximately $80. The cost of either four metal rings or drip pans having warning symbols thereon would be expected to be well below a fourth of that cost. Thus the individuals could just purchase the metal rings or the drip pans that contain heat warning symbols and improve the safety of their stove. In this regard, it is noted that people do like to routinely replace their drip pans and metal rings (Trim Rings®) for cosmetic reasons.

In this way, the heat warning symbol would not be adversely affected by friction caused by movement of the pots and pans on the electric coil whereas if the heat warning symbol were on the disk in the center of the electric coil roughly at the height of the coil itself the warning symbol could be so adversely affected. Furthermore, the heat warning symbol of the present invention is not vulnerable to the collection of dirt and grime in crevices found between one part of the heat warning device and another or between the heat warning device and the surrounding surface it is on. Although placing the heat warning symbol on the drip pan or metal ring would be imperfect since the metal ring or drip pan would cool down to below the too hot to touch temperature (for example, 115 degrees Fahrenheit) much sooner than the electric coil, this would be taken into

consideration. Accordingly, in a preferred version of this embodiment, the thermochromic composition making up the heat warning symbol on the rings could be calibrated so as to warn of dangerous heat whenever the temperature of the actual coil was too hot.

It is noted that in any embodiment, whenever the heat warning symbol is not on the actual "target surface" being warned against for heat (the improved metal grate with the symbol on the base of the grate *not* being an example of such an embodiment) the heat warning symbol must be in a fixed relation thereto. There would be almost no point in calibrating the heat dissipation between a metal ring and an electric coil if the metal ring could be moved even a quarter of an inch, which could occur if the metal ring were not spatially fixed with respect to the electric coil. Another requirement is that between the heat warning symbol and the target surface there are materials whose heat conductivity is clearly defined and measurable. An additional requirement is that the discrepancy in temperature between the target surface and the heat warning symbol not be too great, as explained above.

In accordance with one embodiment of the present invention, a metal ring that holds up the drip pan is sold under the brand name Trim Ring® by a company called Range Kleen. The metal ring's upper surface has an outer annular portion that in certain embodiments is partially visible to a user of the electric stove even when the drip pan is inserted thereon. This metal ring would surround the serpentine electric coil or other heating element and would rest at least partially on the top surface of the electric stove. In accordance with the present invention, a heat warning symbol would be located on the visible outer annular portion of the upper surface of the metal ring. The symbol warns that the ring is hot and by implication that the electric coil heating element and/or drip pan is hot. The heat warning symbol on the surface of the outer annular

portion of the ring would be a thermochromic composition shaped in a predetermined symbol or in the background of said symbol which communicates that the surface is dangerously hot, the symbol designed to undergo and maintain a readily perceptible color change whenever and so long as the temperature of the surface exceeds a predetermined temperature. The thermochromic composition would be capable of withstanding temperatures in excess of approximately 300 degrees Fahrenheit. The thermochromic composition would not be bulky and in a preferred embodiment would having a thickness of less than approximately one sixteenth of an inch and lacking any covering or overcoat. In a preferred embodiment, the thermochromic composition would be substantially invisible against a background color of the outer portion of the upper surface of the metal ring and would become readily visible against that background color or would reveal a heat symbol that is readily visible against that background color whenever and so long as the specified temperature is reached.

Accordingly, in embodiments in which the heat warning symbol appears on the surface of the metal ring, as seen from the drawings, this metal ring is in fixed relation to the electric coil or other heating element, which is the primary target surface. This may be accomplished by the fact that the metal ring engages the edge of the recess in the burner area of the stove into which are placed, in the example of an electric heating element, the electric coil, its support grate and the metal bowl. Other ways may easily be imagined of ensuring this fixed relation between the accessory containing the heat warning symbol, i.e. the metal ring or drip pan, and the target surface such as the surface of the heating element or surrounding accessories and surfaces.

As noted, a further important surface that often gets hot and stays hot after the source of the heat has been removed and hence requires a heat warning is the surface of another accessory

called a drip pan (referred to above) that in the case of an electric stove supports a grate and the insulated serpentine electric coil heating element on the grate on the top surface of the electric stove. The accessory is essential a metal bowl having an upper lip and a substantially hemispheric bowl wall.

The upper lip of the drip pan typically sits on a metal ring as described above, which metal ring engages a substantially smooth surface of a top of the electric or other stove. The entire heating element and drip pan is usually situated in one of four (or other number of) recesses in the top surface of the stove. One or more heat warning symbols as previously described and in accordance with the present invention would be positioned on a surface of the upper lip of the drip pan for warning individuals that the metal bowl, electric coil and/or metal ring is hot. The surface of the upper lip would be visible to users of the electric stove when the bowl is fixed in position supporting the electric coil and grate. As noted, the bowl is used primarily for collecting food residue that drips beneath the heating element. In certain embodiments the bowl wall has a second lip along the bowl wall.

Another surface that gets very hot and remains hot even after the heat source is turned off and which would not accommodate a very bulky heat warning device is the surface of an indoor or outdoor grill, for example a barbecue grill. In the case of an outdoor grill, an improved grill of the present invention would include a plurality of parallel metal tubular bars on which food is exposed to heat, a support, such as one or more crossbars, for holding the bars together, and a hollow container for supporting the bars (with its support). The hollow container also contains a heating element. The heating element can be an electric heating element or hot "burning" charcoals, or another suitable heat source. It should be understood that the bars are typically

parallel or substantially parallel but they need not be. "Substantially parallel" as used herein means that two bars, if extended indefinitely, would meet at an angle of between 140 and 180 degrees of each other. Furthermore, it should be understood that the bars are typically tubular but need not be. The basis idea of this embodiment of the present invention is a grill having a heat warning symbol thereon made of a thermochromic composition in the shape of a warning symbol. It should also be understood that the word "hollow" in the phrase "hollow container" merely means that the container contain some free area in which the heating element is placed. The lower area of the bars and any support either descends somewhat into the hollow container or else rests on an upper edge thereof. FIGS. 19-20 depict an indoor grill showing the bars somewhat thicker than they might ben - but this is merely illustrative and one example. FIG. 20a shows a fragmentary view of an outdoor grill where a hollow container 150 is supporting the bars 130 and support, rather than a drip pan. Symbol 21 made of composition 20 is directly on an outer perimeter 166 of the grill atop container 150. It should be appreciated that while FIG. 20a depicts outer perimeter 166 in one particular configuration projecting outward, numerous other configurations of outer perimeter 166 would also be within the scope of the present invention. Heating element 170 is somewhere in the container of the outdoor grill. The heating element 170 for the indoor grill can be in any suitable place below the bars 130. In FIG. 20 metal ring 300 engages top of stove 119.

As seen from FIGS 19 and 21, whenever the stove has multiple burners, for example four of them, the symbol 21 is positioned so that it faces the user from any direction he or she approaches the stove. Note however that the grill in FIG. 19 and the griddle in FIG. 21 can be said to represent the southwestern corner of a stove top and that therefore there are two symbols

that have the heat symbol facing in both directions since in each of these cases that symbol can forewarn against an approach of a hand both from across an adjacent burner as well as from across the actual burner that the symbol is on..

The grill includes an outer perimeter having a visible surface. On the visible surface are one or more heat warning symbol made of a thermochromic composition shaped in a predetermined symbol or in the background of said symbol which communicates that the surface is dangerously hot, the symbol designed to undergo and maintain a readily perceptible color change whenever and so long as the temperature of the surface exceeds a predetermined temperature. The symbol(s) warn that the grill is hot. The thermochromic composition is capable of withstanding temperatures in excess of approximately 300 degrees Fahrenheit and would not be bulky. For example, the heat warning symbol made of the thermochromic composition would preferably have a thickness of less than approximately one sixteenth of an inch. In a preferred embodiment, the composition would be applied directly to the surface by being sprayed, stenciled, printed, embossed, silkscreened or stamped on as a liquid that dries. Accordingly, the thermochromic composition would not have any covering or overcoat in a preferred embodiment. In a preferred embodiment, the thermochromic composition would be substantially invisible against a background color of the visible surface of the grill and would become readily visible against that background color whenever or would reveal a heat symbol that is readily visible against that background color and so long as the specified temperature is reached.

Typically, the grill has a visible outer perimeter. The outer perimeter is at or near a conjunction of the hollow container and the plurality of metal bars. In certain embodiments, this perimeter has a top surface that is slightly lower than the top surface of the bars of the grill on

which the meat or other food is placed. However, this is not a critical feature since the food on the grill is usually not large enough to intrude onto the outer perimeter and affect the durability of any heat warning device located thereon. Accordingly, in accordance with this embodiment of the present invention, a heat warning symbol in accordance with the present invention would be placed on that outer perimeter. Thus, the present invention contemplates an improved grill for heating meat and other food safely.

The present invention also applies to an indoor grill, one which can be fitted directly into the recess on top of stove after the electric coil or other heating element has been removed. In this case, as best seen from FIGS. 21 and 22, the grill has a drip pan under it and typically has a metal ring surrounding the drip pan for holding up the drip pan, as was described in the context of the electric coil heating element for an electric stove. Accordingly, the heat warning symbol can appear on the upper lip 220 of drip pan 200, as seen in FIGS 21-22, or on the metal ring 300 surrounding the drip pan (not shown precisely in the context of a drip pan around a grill) in accordance with the present invention.

In each embodiment of the accessory and improved grill, improved griddle, improved metal grate, it is contemplated as an alternative that a thin buffer layer of thermally conductive adhesive is situated underneath the thermochromic composition and heat warning layer in order to reduce the temperature of the thermochromic composition, since grills, griddles and even their accessories surrounding them (drip pans, metal rings, etc.) can get extremely hot. Accordingly, although this may seem most useful with thermochromic composition located on the surface of a griddle or grill it could also be applied to the composition on a drip pan, metal ring or other accessory surrounding a heating element.

Accordingly, although the buffer layer is shown only in FIGS. 14a and FIG. 22, and not on FIGS. 12, 16, 18, 20 and 24, the other embodiments also have alternative variations that include the buffer layer, although the insertion of this layer is not shown on all of the drawings.

The thermally conductive adhesive, for example ceramic or epoxy adhesive made by Cotronics Corp. of Brooklyn, New York, would be placed directly on the outer perimeter surface of the grill and the thermochromic composition (and in certain embodiments a printed or inscribed symbol under this composition) would then be applied directly on top of the buffer layer of thermally conductive adhesive. The buffer layer is capable of withstanding the very high temperatures on the outer perimeter of the grill. Depending on the grill's heating element and diameter, that temperature can be between approximately 400 degrees Fahrenheit and approximately 900 degrees Fahrenheit.

Although the thermochromic composition does not require an overcoat, in certain embodiments where the surface is exposed to sunlight, since thermochromic compositions deteriorate with exposure to ultra violet radiation, a UV filter can be applied as a top clear (see-through) overcoat. In such embodiments, it is also contemplated to position the heat warning device on a side of the appliance, such as an outdoor grill, to hide it from exposure to sunlight.

Another surface that gets very hot and remains hot even after the heat source is turned off and which would not accommodate a very bulky heat warning device is the surface of an indoor or outdoor griddle. In the case of an indoor griddle, the griddle can be fitted directly into the recessed burner area of the top surface of a stove that previously was fitted with an electric heating element. Such a griddle is depicted in FIGS. 21-24. In FIGS. 21-22, the heat warning symbol is on the lip of the drip pan. In FIGS. 23-24, the heat warning symbol is on a visible

surface of the metal ring itself. Obviously, combinations of these two versions can be implemented as well.

Although FIG. 24 in its entirety represents an indoor griddle since it includes drip pan 200 and metal ring 300 adjacent flat metal surface 240, FIG. 24 taken without drip pan 200 and without ring 300 can also be imagined and in this case these would represent the essential elements of the outdoor grill of the present invention together with heat symbol 21 on flat metal surface 240. Likewise, the same outdoor grill (without drip pan 200 or metal ring 300) that includes buffer layer 260 can also be appreciated from imagining FIG. 22 without the drip pan 200 and metal ring 300.

In the case of an indoor griddle, which may be less susceptible to the application of accessories such as a drip pan or a metal ring, an embodiment of the present invention is an improved griddle itself which comprises a flat metal surface 240 on which food is exposed to heat, a source of heat 244 connected to the flat metal surface, the flat metal surface including an outer perimeter, the outer perimeter having a visible surface, and a heat warning symbol on the visible surface of the outer perimeter. However, in this case, since the surface of a griddle gets extremely hot, such as 900 degrees Fahrenheit in some cases, it is preferred, before applying the heat warning symbol to the outer perimeter of the griddle, to first provide for a thin heat conducting layer that creates a buffer between the thermochromic composition in the heat warning symbol and the surface of the griddle. The buffer layer reduces the maximum temperature the thermochromic composition will be exposed to. For example, a thin layer 260 of certain epoxy can be both heat conducting but also capable of withstanding temperatures of over 900 degrees Fahrenheit. Such epoxies are well known - for example ceramic and epoxy adhesives

manufactured by Cotronics Corp. of Brooklyn, New York under various product names such as Durabond® and other product names. In some case such an epoxy or ceramic adhesive can also be modified to control the exact degree of its heat conductivity and the temperature up to which it can withstand by installing metallic fibers into the adhesive. Such thermally conductive metall-filled adhesives are sold by Cotronics Corp.

The buffer layer 260 is merely reducing the heat and not eliminating it so the epoxy or ceramic adhesive can be thin enough that the total combined thickness of the heat warning symbol and the buffer layer of adhesive is still less than one sixteenth of an inch, and certainly less than one eighth of an inch. The heat warning symbol 21 would be applied directly to the buffer layer of adhesive or other material instead of directly to the metallic surface. Accordingly, the buffer layer of adhesive in accordance with the present invention would be capable of withstanding the very high temperature typically reached on the flat metal surface of the improved griddle. The buffer layer would be tailored to the particular improved griddle involved. For residential griddles, that temperature would be lower than for commercial griddles. For example, for residential griddles, that temperature might be approximately 700 degrees Fahrenheit. For commercial griddles, that temperature may be approximately 900 degrees Fahrenheit.

The heat warning symbol would once again be made of a thermochromic composition shaped in a predetermined symbol or in the background of said symbol which communicates that the surface of the griddle is dangerously hot, the symbol designed to undergo and maintain a readily perceptible color change whenever and so long as the temperature of the surface of the griddle exceeds a predetermined temperature. As noted in the context of the other embodiments, due to the discrepancy between the temperature of the griddle and that of the heat warning

symbol because of the epoxy buffer, the triggering temperature at which the symbol will change color and become visible will be calibrated so as to be appropriately lower than the actual temperature at which it is dangerously hot to touch the griddle in order to take this discrepancy into consideration. The thermochromic composition is capable of withstanding temperatures in excess of approximately 300 degrees Fahrenheit. It can be effective with target surface temperatures that greatly exceed that amount, up to approximately 600 degrees to 1200 degrees Fahrenheit The exact target surface temperature of the griddle would depend upon the size of the griddle and the distance of the outer perimeter from the heat source.

The thermochromic composition is not bulky and in a preferred embodiment has a thickness of less than approximately one sixteenth of an inch and in a preferred embodiment lacks any covering or overcoat. Once again, in a preferred embodiment, the thermochromic composition would be substantially invisible against a background color of the visible surface and would become readily visible against that background color or would reveal a heat symbol that is readily visible against that background color whenever and so long as the threshold temperature is reached.

Assembly Embodiment

The concept of the present invention whereby heat warning symbols are applied to surfaces of hot appliances can be extended to an assembly 100 of devices 10 of the present invention. The combination of the devices 10 forming assembly 100 provides a system of maximum protection to a whole family so that any and all surfaces of the appliance or other object can be protected with warning devices. For example, a toaster's surfaces may cool to below the specified temperature at different times so the user needs to place warning device on different

surfaces of the toaster.

The assembly 100 includes a plurality of heat alert warning devices that can be placed on more than one surface of an appliance. The assembly 100 includes one or more devices of a first type 10A attachable to a first surface 30A of the appliance, the device of the first type 10A comprising a thermochromic composition 20 shaped in a predetermined symbol or in the background of such symbol which communicates that the surface is dangerously hot, the symbol substantially invisible against a background color of the surface and designed to undergo and maintain a readily perceptible color change so that the symbol is readily visible against said background color whenever and so long as the temperature of the surface exceeds a predetermined temperature, the thermochromic composition capable of being applied as a liquid directly to the first surface in the predetermined shape, capable of remaining on the first surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit, the thickness in solid form of said thermochromic composition being such that said thermochromic composition is either faintly visible or invisible when viewed from a line of sight tangent to the first surface by someone whose attention is not specifically directed to said thermochromic composition. Assembly 100 also includes one or more devices of a second type 10B attachable to a second surface 30B of the appliance, said device of the second type comprising a thermochromic composition shaped in a predetermined symbol or in the background of such symbol which communicates that the surface is dangerously hot, wherein an outline of the symbol is visible against a background color of the surface and a remainder of the symbol is substantially invisible against a background color of the surface, the remainder of the symbol designed to undergo and maintain a readily perceptible color change so that said remainder is

readily visible against said background color whenever and so long as the temperature of the surface exceeds a predetermined temperature, the thermochromic composition capable of being applied as a liquid directly to the surface in the predetermined shape, capable of remaining on said surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit, the thickness in solid form of the thermochromic composition being such that said thermochromic composition is either faintly visible or invisible when viewed from a line of sight tangent to the second surface by someone whose attention is not specifically directed to said thermochromic composition. The assembly 100 could be limited to the two surfaces or could optionally also include one or more additional devices that are of the first type or of the second type attachable to one or more additional surfaces of the appliance.

The assembly 100 can include as many devices 10 as is practical and appropriate. Furthermore, the assembly 100 contemplates that there can be more than one device 10 of the first type 10A on the first surface 30A and more than one device 10 of the second type 10B on a second surface 30B.

Multiple Segment Embodiment

The present invention also contemplates that the device 10 can communicate not just that a surface is dangerously hot but also varying levels of dangerously hot, i.e. varying degrees of heat on that surface. As seen in FIGS. 9, 10, 11A and 11B, the device 10 can be divided in segments of two, three or any other number. Typically, there would not be more than three segments because it is not necessary usually to communicate more than three levels of heat. In addition, one does not want to clog the visual space of the surface.

In accordance with this embodiment, the heat warning safety device 10 can be described

as comprising a thermochromic composition 20 shaped in a predetermined symbol, the symbol having multiple segments, or in the background of such symbol, which symbol communicates that the surface is dangerously hot to a particular level, each segment 50A, 50B except one communicating a different level of a degree to which the surface is dangerously hot and one segment 50C communicating that the surface is not dangerously hot until the surface temperature exceeds the predetermined temperature, all segments of the symbol except one substantially invisible against a background color of the surface and at least one segment of said symbol designed to undergo and maintain a readily perceptible color change so that said at least one segment is readily visible against said background color whenever and so long as the temperature of the surface exceeds the predetermined temperature, and a second segment of the symbol designed to undergo and maintain a readily perceptible color change so that said second segment is readily visible against the background color whenever and so long as the temperature of the surface exceeds a second predetermined temperature, said second predetermined temperature being higher than said predetermined temperature, the thermochromic composition capable of being applied as a liquid directly to the surface in the predetermined shape, capable of remaining on said surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit, the thickness in solid form of said thermochromic composition being such that said thermochromic composition is either faintly visible or invisible when viewed from a line of light tangent to the surface by someone whose attention is not specifically directed to said thermochromic composition.

For example, as seen in FIGS. 11B in general and FIG. 9 as applied to a cup and a lid, one segment of symbol would for example communicate the word "OK" to tell the consumer that they

can put the appliance away and it is not hot. Among the remaining two segments, a first segment would communicate the word "HOT" when the surface exceeded the predetermined temperature and a second segment would communicate "VERY HOT" whenever and so long as the surface temperature exceeded a second (higher) predetermined temperature. FIG. 11A in general and FIG. 10 applied to a lid of a cup, show the same idea except there are only two segments of the heat warning symbol - the "HOT" segment 60A that communicates that the temperature of the surface exceeded a predetermined temperature and which is presently invisible and the "OK" segment 60B that affirmatively communicates that the surface is not dangerously hot and be touched or moved and which is depicted as visible. Accordingly, even though only one of the segments is active in the drawings of these segmented symbols in FIGS. 9-10 and 11A-11B, there are one or two other segments that although invisible contain another symbol segment For example, in FIG. 11B, only the "VERY HOT" segment is active, the "OK" and the "HOT" segments are invisible since they are not active.

The above segment 50C which notifies the consumer that the surface is no dangerously hot can be accomplished by a thermochromic composition since thermochromic composition are well known to change color in either direction. In other words, instead of turning red for example when the predetermined temperature is exceeded, as is the case with the segments communicating "HOT" and "VERY HOT", the segment communicating "OK" turns red or another color different than the background color whenever the temperature goes below the predetermined temperature.

It should be noted that although FIGS. 9, 10, 11A and 11B depict the segments are part of a type one symbol - i.e. it is invisible when not active and it is visible when active (as opposed to a type two symbol whose outline is always visible even when not active) - it is of course

contemplated by the present invention that the same segment embodiment or other alternative embodiment can be accomplished using the type two symbols or even combinations of the two types of symbols.

It should be noted that FIGS. 9, 10, 11A and 11B do not depict lines dividing the segments within a symbol. The present invention only contemplates using the thermochromic composition to do so where doing so does not impair the objective of not clogging the visual space.

The present invention also contemplates combining the segment embodiment with the assembly embodiment. Accordingly, assembly 100 of devices 10 incorporates the "segment" embodiment just described. Such an assembly can be described as a heat warning safety device assembly 100 attachable to multiple surfaces of an appliance, the assembly 100 for warning individuals that one of more of the surfaces are hot. The assembly 100 comprises a plurality of heat alert warning devices including one or more devices of a first type 10A attachable to a first surface 30A of the appliance, the device of the first type 10A comprising a thermochromic composition shaped in a predetermined symbol, the symbol having multiple segments, or in the background of such symbol, which symbol communicates that the first surface is dangerously hot to a particular level, each segment except one communicating a different level of a degree to which the first surface is dangerously hot and one segment communicating that the first surface is not dangerously hot, the symbol substantially invisible against a background color of the surface and at least one segment of said symbol designed to undergo and maintain a readily perceptible color change so that said at least one segment is readily visible against said background color whenever and so long as the temperature of the surface exceeds a predetermined temperature, and

a second segment of said symbol designed to undergo and maintain a readily perceptible color change so that said second segment is readily visible against said background color whenever and so long as the temperature of the surface exceeds a second predetermined temperature, said second predetermined temperature (i.e. "VERY HOT") being higher than said predetermined temperature (i.e. "HOT"), the thermochromic composition capable of being applied as a liquid directly to the surface in the predetermined shape, capable of remaining on said surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit, the thickness in solid form of said thermochromic composition being such that said thermochromic composition is either faintly visible or invisible when viewed from a line of sight tangent to the first surface by someone whose attention is not specifically directed to said thermochromic composition. This assembly 100 also includes one or more devices of a second type 10B attachable to a second surface 30B of the appliance. The device of the second type 10B comprises a thermochromic composition shaped in a predetermined symbol or in the background of such symbol which communicates that the surface is dangerously hot, wherein an outline of the symbol is visible against a background color of the surface and a remainder of the symbol is substantially invisible against a background color of the surface, and wherein the remainder of the symbol is designed to undergo and maintain a readily perceptible color change so that said remainder is readily visible against said background color whenever and so long as the temperature of the surface exceeds a predetermined temperature. As before, the thermochromic composition is capable of being applied as a liquid directly to the surface in the predetermined shape, capable of remaining on said surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit. The thickness in solid form of

the thermochromic composition is such that the thermochromic composition is either faintly visible or invisible when viewed from a line of sight tangent to the second surface by someone whose attention is not specifically directed to said thermochromic composition.

Optionally, assembly 100 also includes one or more additional devices that are of the first type or of the second type and that are attachable to one or more additional surfaces of the appliance.

It should be noted that in this description only the first type 10A of device 10 in assembly 100 is segmented to communicate varying degrees of heat including "VERY HOT", "HOT" and "OK". However, the present invention certainly also contemplates embodiments in which the second type 10B of device 10 in assembly 100 is segmented. The present invention also contemplates an embodiment in which both the first type 10A and the second type 10B of device 10 are segmented. Furthermore, there can be additional devices on additional surfaces that can be segmented. Furthermore, it is also contemplated by the present invention that the amount of segmentation (the number of segments in the heat warning symbol) and the type of segmentation (the subsymbol used in the segment) can vary from one surface to another within the assembly of devices and even can vary within the devices that are placed on a single surface of an appliance.

Additional Embodiments

As seen in FIGS. 9-10, the present invention also contemplates an embodiment wherein a heat warning safety device is attachable to a cup or the lid of a cup or other container that holds a hot liquid, for advertising the temperature of the liquid. Such a device 80 comprises a thermochromic composition shaped in a predetermined symbol or in the background of such symbol which communicates that a top surface of the lid is dangerously hot, the symbol

substantially invisible against a background color of the surface and designed to undergo and maintain a readily perceptible color change so that the symbol is readily visible against said background color whenever and so long as the temperature of the top surface of the lid exceeds a predetermined temperature, said predetermined temperature of the top surface of the lid calibrated to reflect a higher temperature of the liquid in the cup by taking into consideration an expected specified amount of heat dissipation between the liquid and the lid, the thermochromic composition capable of being applied as a liquid directly to the surface in the predetermined shape, capable of remaining on said surface in its predetermined shape in solid form, and capable of withstanding temperatures in excess of 300 degrees Fahrenheit, the thickness in solid form of said thermochromic composition being such that said thermochromic composition is either faintly visible or invisible when viewed from a line of light tangent to the surface by someone whose attention is not specifically directed to said thermochromic composition.

In general, it is to be understood that while the apparatus of this invention have been described and illustrated in detail, the above-described embodiments are simply illustrative of the principles of the invention. It is to be understood also that various other modifications and changes may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof. It is not desired to limit the invention to the exact construction and operation shown and described. The spirit and scope of this invention are limited only by the spirit and scope of the following claims.